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(54) MOVABLE BODY SYSTEM

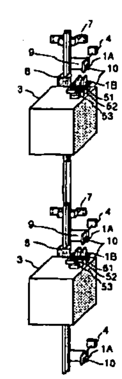
(57) A first object of the invention is to provide a movable body system having a guide rail to guide a movable body and having power feeder devices disposed at proper positions.

A second object of the invention is to provide a movable body system having a guide rail to guide a movable body and having primary and secondary transformers suitable for the system.

In order to achieve the first object of the invention, a power transmitter is mounted on a guide rail, or a portion of the power transmitter is mounted on a member for supporting the guide rail or on a rail bracket for supporting the guide rail.

In order to achieve the second object of the invention, an outer end of a primary transformer on the movable body side is positioned nearer to the movable body side than an outer end of a secondary transformer, as projected the outer ends along a motion direction of the movable body.

FIG.1



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Description

TECHNICAL FIELD

[0001] The present invention relates to power feeding for a movable body system having a movable body to be guided by a guide rail.

BACKGROUND ART

[0002] A conventional movable body system using a guide rail is disclosed, for example, in Japanese Patent Laid-open Publications Nos. SHO-57-121568 and HEI-5-294568.

[0003] According to the conventional techniques described in Japanese Patent Laid-open Publication No. SHO-57-121568, an inverter and a charger are mounted on a counterweight on the primary side of a linear motor. This charger is connected to a main power source system, riding upon a sonnet connector, to be supplied with an electric power when the counterweight stops at a bottom position.

[0004] Japanese Patent Laid-open Publication No. HEI-5-294568 discloses that power is supplied in a non-contact manner to an elevator cage when the cage arrives at the elevator stop floor.

[0005] Although the technical field is different from that of the movable body system using a guide rail, conventional techniques described in Japanese Patent Laid-open Publications Nos. HEI-11-285156 and HEI-8-37121 disclose a power feeding method by non-contact power feeding which is applied to an electric automobile and an electric shaver. According to the conventional techniques described in Japanese Patent Laid-open Publication No. HEI-11-285156, the core shape is devised to make the device compact. According to the conventional techniques described in Japanese Patent Laid-open Publication No. HEI-8-37121, the core winding position is devised to suppress a transformer coupling factor from being lowered.

[0006] However, the conventional techniques described in the Japanese Patent Laid-open Publications Nos. SHO-57-121568 and HEI-5-294568 disclose none of the specific mount position of a power feeder.

[0007] The conventional techniques described in the Japanese Patent Laid-open Publications Nos. HEI-11-285156 and HEI-8-37121 are associated with a high transformer coupling factor and do not consider the essential issue that the primary and secondary transformers pass by when a moving body moving along a guide rail is used as in the case of an elevator.

DISCLOSURE OF INVENTION

[0008] A first object of the invention is to provide a movable body system having a guide rail to guide a movable body and having power feeder devices disposed at proper positions.

[0009] A second object of the invention is to provide a movable body system having a guide rail to guide a movable body and having primary and secondary transformers suitable for the system.

[0010] In order to achieve the first object of the invention, a power transmitter is mounted on a guide rail, or a portion of the power transmitter is mounted on a member for supporting the guide rail or on a rail bracket for supporting the guide rail.

[0011] In order to achieve the second object of the invention, an outer end of a primary transformer on the movable body side is positioned nearer to the movable body side than an outer end of a secondary transformer, when the outer ends are projected along a motion direction of the movable body.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] Fig. 1 is a diagram showing the structure of a movable body system according to a first embodiment of the invention. Fig. 2 is a diagram showing another mount example of a power transmitter. Fig. 3 is a diagram showing another power feeding method. A waveform diagram of a DC reactor current of a charge/discharge controller shown in Fig. 2. Fig. 4 is a diagram showing an example of the structure shown in Fig. 1 and applied to an elevator. Fig. 5 is a diagram showing an application of the example shown in Fig. 4. Fig. 6 is detailed diagrams showing an elevator cage and elevator stop side doors as viewed from a lifting path side. Fig. 7 is enlarged views of a power receiver 201B shown in Fig. 6(a). Fig. 8 is enlarged views of a power receiver 205B and a power transmitter 205B shown in Fig. 6. Fig. 9 is enlarged views of a power receiver 202B and a power transmitter 202A shown in Fig. 6. Fig. 10 is enlarged views of a power receiver 203B and a power transmitter 203A shown in Fig. 6. Fig. 11 is enlarged views of a power receiver 204B shown in Fig. 6. Fig. 12 is enlarged views of a power receiver 206B and a power transmitter 206A shown in Fig. 6. Fig. 13 is an enlarged view of a power receiver 207B shown in Fig. 6. Fig. 14 is diagrams of engaging plates 105 and engaging rollers 112. Fig. 15 is diagrams showing the mount state that the engaging plates 105 and the engaging rollers 112 shown in Fig. 14 are mounted on a power receiver 208B and a power transmitter 208A. Fig. 16 is diagrams of an elevator cage and elevator stop side doors as viewed from the lifting path side, respectively of an elevator providing a door open/close operation different from that shown in Fig. 6. Fig. 17 are enlarged views of an engaging plate 121 and an engaging device 122 shown in Fig. 16. Fig. 18 are diagrams of a movable body side power receiver 209B and a charger side power transmitter 209A respectively mounted on the engaging plate 121 and the engaging device 122 shown in Fig. 17. Fig. 19 is a top view of a charger side transformer 1A and a movable body side transformer 1B during power feeding. Fig. 20 is cross sectional views of a charger side transformer

1A0. Figs. 21 to 24 are diagrams of transformers according to various embodiments. Fig. 25 is diagrams illustrating comparison between coupling factors with different coil shapes and positions of the same CI-type transformer. Fig. 26 is a diagram showing an example of a transformer having a coil aspect ratio of 1 or smaller. Fig. 27 is a top view of a guide plate 8. Fig. 28 is an illustrative diagram of a guide shoe. Fig. 29 are side views of a charger side transformer 1A0. Fig. 30 is a side view of a movable body side transformer 1B0. Fig. 31 is comparison diagrams illustrating transformer mounting methods. Fig. 32 is a diagram showing an example of a CI-type transformer mounted at a different position.

BEST MODE FOR CARRYING OUT THE INVENTION

[0013] Embodiments of the invention will be described with reference to the accompanying drawings.

[0014] Fig. 1 shows the first embodiment of the invention. 1A represents a charger side power transmitter, 1B represents a movable body side power receiver, 3 represents a movable body, 4 represents a charger, 51 represents a rectifier, 52 represents a battery, 53 represents an inverter, 6 represents a guide rail, 7 represents a rail bracket, 8 represents a guide plate, and 10 represents an insulator. The movable body side power receiver 1B, rectifier 51, battery 52 and inverter 53 are mounted on the movable body 3.

[0015] The movable body 3 may be a cage of an elevator, a counterweight of an elevator, a cage of a cable car, an automatic transporter or the like. If the movable body 3 is the cage of an elevator or the cage of a cable car, the subject to which power is supplied may be an illuminating device in a cage, a door motor, buttons in a cage or the like. If the movable body 3 is a counterweight, the subject to which power is supplied may be a drive motor of a weight drive elevator. If the movable body 3 is an automatic transporter, the subject to which power is supplied may be a drive motor. Although the first embodiment assumes a multi-car and a plurality of movable bodies 3 are drawn, it is obvious that only a single movable body may be used.

[0016] The charger 4 is mounted on a lifting path wall. The charger 4 converts a power supplied from an unrepresented commercial power source into a d.c. power or a high frequency power of several tens kHz to several hundreds kHz and supplies it to the charger side power receiver 1A. Power is supplied from the charger side power transmitter 1A to the movable body side power receiver 1B through contact power feeding with direct contacts of conductors, non-contact power feeding utilizing magnetic coupling, non-contact power feeding utilizing microwaves, or non-contact power feeding utilizing solar cells. Power sent to the movable body side power receiver 1B is converted into a d.c. power by the rectifier 41 and stored in the battery 52 (If the supplied power is a d.c. power, the rectifier 41 may be omitted.). The power stored in the battery is supplied to the movable body via the inverter.

[0017] Power is fed when the movable body 3 is at a position where doors on the building side are positioned, i.e., at a position where the movable body stops for the purpose other than power feeding, or at a power feeding position where the charger side power transmitter 1A and movable body side power receiver 1B face each other. If the charger side power transmitter 1A and the movable body side power receiver 1B do not face each other, power is not fed. Therefore, not only energy savings are realized, but also it is possible to prevent deterioration by arcs or the like which may be caused during contact power feeding and adverse effects by electromagnetic forces which may be caused during non-contact power feeding.

[0018] Next, description will be made on the mount positions of the charger side power transmitter 1A and the movable body side power receiver 1B of the first embodiment shown in Fig. 1.

[0019] For example, in the case that the power feeding method is non-contact power feeding, the charger side power transmitter 1A and the movable body side power receiver 1B may collide and they may be broken if a mount precision of the charger side power transmitter 1A and a position precision of a motion guide for the movable body side power transmitter 1B are low. If a gap between the charger side power transmitter 1A and the movable body side power receiver 1B is broadened to avoid collision, the coupling factor (power transmission efficiency) lowers considerably (this will be later detailed). In the case that the power feeding method is contact power feeding, contact failure may occur if the position precision is low or corrosion may be accelerated if the transmitter and receiver contact with an unnecessarily strong force. It is therefore necessary to have a high position precision between the charger side power transmitter 1A and the movable body side power receiver 1B.

[0020] Referring to Fig. 1, the guide rail 6 is a rail for guiding the motion of the movable body 3, and is fixed to a lifting path by the rail bracket 7. In an elevator system, the guide rail is installed at a flatness precision of 1 mm or smaller per 1 m length in order to suppress swinging of the cage. In order to satisfy this requirement, the rail bracket 7 serves as a support stage for fixing the guide rail to the lifting path. The lifting path wall has a low flatness precision because of irregular surfaces of a concrete wall and a joint between concrete blocks. Namely, as compared to the lifting path wall, the flatness precision of the guide rail 6 and rail bracket 7 is very high.

[0021] In the first embodiment, the charger side power transmitter 1A is fixed to a charger side power transmitter fixing jig 9 adhered to the guide rail 6, to thereby utilize the high precision of the guide rail. With this structure, the position displacement (mount distortion) of the power transmitter and power receiver in the power feed-

ing state can be made small as compared to that the charger side power transmitter 1A is directly connected to the building side lifting path wall which cannot guarantee the high position precision. Although the charger side power transmitter 1A is fixed to the charger side power transmitter fixing jig 9 in the first embodiment, it may be directly connected to the guide rail, with similar expected effects. If the charger side power transmitter 1A is connected directly to the rail bracket 7 as shown in Fig. 2, the position displacement in the power feeding state can be suppressed similar to that shown in Fig. 1, and in addition the number of components can be reduced effectively. As shown in Fig. 3, current may be flowed directly in the rail to feed power to the movable body side power receiver 1B. In Fig. 3, although the contact power feeding method is illustrated by way of example, the method of flowing current directly in the rail may be applied to the non-contact power feeding. Since the rail also serves as the power feeding line, the number of components can be reduced considerably and the area of the lifting path can be reduced effectively.

[0022] In the first embodiment, the charger side power transmitters 1A are mounted not only at the intermediate position of the guide rail 6 but also at the end positions thereof. The effects of this arrangement will be described with reference to Fig. 4 by taking as an example an elevator. In an intermediate area of the rail, the elevator either stops or does not stop. If the elevator does not stop, the maximum speed reaches several tens m/min to several hundreds m/min, whereas if it stops, the speed is very slow. In the end position areas (highest, lowest floors) where the elevator will not move at high speed, the speed, at which the charger side power transmitter 1A and movable body side power receiver 1B reach the confronting position, is always very slow. As compared to that the charger side power transmitter 1a is inserted in the intermediate area of the rail, a countermeasure against the position displacement can be made more easily. Namely, the position displacement countermeasure is necessary if the transmitter 1A is installed in the rail intermediate area, because there is a possibility that the charger side power transmitter 1A and movable body side power receiver 1B may contact violently and they may be broken. On the other hand, the position displacement countermeasure can be made easily if the transmitter 1A is installed in the rail end areas, because there is no possibility that the charger side power transmitter 1A and movable body side power receiver 1B contact violently.

[0023] Fig. 5 shows an application of the case shown in Fig. 4, wherein the charger side power transmitters 1A are disposed in a ceiling portion and a bit portion and the movable body power receivers 1B are disposed in a ceiling portion and a floor bottom portion of the movable body 3. The arrangement shown in Fig. 5 can also have the effects similar to Fig. 4, and the area of the lifting path 2 can be reduced effectively. Members for supporting the rail (or members for bending the rail and fixing it at the ceiling and bit portions) are provided at the ceiling and bit portions. By mounting the charger side power transmitter 1A on these members, the mechanical stability of the transmitter can be increased more than mounting the transmitter on a concrete plane so that the position displacement can be suppressed further. If the power feeding method is contact power feeding, a cushion such as a spring may be disposed between the charger side power transmitter 1A and the above-described member, breakage of the charger side power transmitter 1A and movable body side power receiver 1B can be prevented effectively even if they contact each other violently.

[0024] Next, detailed description will be given on a method of mounting the charger side power transmitter 1A of the first embodiment shown in Fig. 1 assuming that the movable body 3 is an elevator. Figs. 6(a) and 6 (b) are detailed diagrams showing the cage of an elevator and the door area on the elevator stop side as viewed from the lifting path side. 3A represents the cage of an elevator, 101 represents a door motor, 102 represents a hanger case, 103 represents a pulley, 104 represents a door hanger, 105 represents an engaging plate, 106 represents a door on the cage side, 107 represents a door frame on the cage side, 108 represents a support member fixed to the door frame 107 on the cage side, 109 represents a sill on the cage side, 110 represents an apron, 111 represents a door hanger on the elevator stop side, 112 represents an engaging roller, 113 represents a door on the elevator stop side, 114 represents a three-side frame, 115 represents a support member fixed to the three-side frame 114, 116 represents a sill on the elevator stop side, 117 represents a door guard, and 118 represents a position detector. 201B represents a movable body side power receiver mounted on the cage 3A of the elevator, 202B represents a movable body side power receiver mounted on the door 106 on the cage side, 203B represents a movable body side power receiver mounted on the door frame 107 on the cage side, 204B represents a movable body side power receiver mounted on the support member 108, 205B represents a movable body side power receiver mounted on the sill 109 on the cage side, 206B represents a movable body side power receiver mounted on the apron 110, 207B represents a movable body side power receiver mounted near the position detector 118, 201A represents a charger side power transmitter mounted on the elevator stop side, 202A represents a charger side power transmitter mounted on the door 113 on the elevator stop side, 203A represents a charger side power transmitter mounted on the three-side frame 114, 204A represents a charger side power transmitter mounted on the support member 115, 205A represents a charger side power transmitted mounted on the sill 116 on the elevator stop side, and 206A represents a charger side power transmitter mounted on the door guide 117.

[0025] In opening and closing the doors of the elevator, drive force of the door motor 101 mounted on the outer or inner region of the hanger case 102 is transmitted via the pulley 103 to the cage side door hangers 104, engaging plates 105 and cage side doors 106. When the cage 3A of the elevator stops and the cage side doors and elevator stop side doors face each other, the engaging rollers 112 take the state that they are inserted into the region between the engaging plates 105. In this state, as the engaging plate 105 is moved by the drive force of the door motor, the engaging rollers 112 are clutched with the engaging plates 105 so that the hangers 111 and doors 113 on the elevator stop side can be opened or closed. The three-side frame 114 is fitted in the elevator doorway on the elevator stop side to protect the three walls, upper, right and left walls of the building. The cage side sill 109 and elevator stop side sill 116 each have a groove for guiding the opening/closing of the doors. In the elevator system, a step between the cage side sill 109 and elevator stop side sill 116 is controlled to be set to ± 5 mm. The apron 110 and door guard 117 are made of metal plates and are provided for preventing a passenger from falling down into the lifting path when the elevator cage 3A stops at a position other than the normal stop position in an emergency case and the passenger tries to get out of the cage. The position detector 118 detects the position of the elevator cage 3A.

[0026] When the cage side doors 106 and elevator stop side doors 113 take a confronting position, the charger side power transmitter 201A and movable body side power receiver 201B, the charger side power transmitter 202A and movable body side power receiver 202B, the charger side power transmitter 203A and movable body side power receiver 203B, the charger side power transmitter 204A and movable body side power receiver 204B, the charger side power transmitter 205A and movable body side power receiver 205B, and the charger side power transmitter 206A and movable body side power receiver 206B, respectively, face each other. This state of each confronting pair will be described in detail hereinbelow.

[0027] Fig. 7 are enlarged views showing the region of the movable body side power receiver 201B mounted on the elevator cage 3A shown in Fig. 6(a). Fig. 7(a) is a diagram illustrating contact power feeding, wherein the movable body power receiver (electrode made of a conductor) 201B is buried in the cage wall. Power feeding is performed when the elevator cage stops at the elevator stop and the movable body power receiver 201B on the cage side and an unrepresented charger side power transmitter mounted on the elevator stop side contact each other. Fig. 7(b) is a diagram illustrating non-contact power feeding through magnetic coupling, wherein the movable body power receiver (non-contact power feeding transformer) 201B is buried in the cage wall. Power feeding is performed through magnetic coupling when the elevator cage stops at the elevator stop and the movable body power receiver 201B (non-contact power feeding transformer) on the cage side and an unrepresented charger side power transmitter (non-contact power transformer) mounted on the elevator stop side face each other. Non-contact power feeding is advantageous in that there is no fear of deterioration and breakage to be caused by contacts. Fig. 7(c) is a diagram illustrating non-contact power feeding by microwaves, wherein the movable body power receiver (microwave power receiver) 201B is buried in the cage wall. Also in this case, power feeding is performed when the elevator cage stops at the elevator stop and the movable body power receiver (microwave power receiver) 201B on the cage side and an unrepresented charger side power transmitter (microwave power transmitter) mounted on the elevator stop side face each other. Fig. 7(d) is a diagram illustrating non-contact power feeding by a solar cell, wherein the movable body power receiver (solar cell panel) 201B is buried in the cage wall. When the elevator cage stops at the elevator stop, the charger side power transmitter (light source) 201A mounted on the building side emits light so that the movable body side power receiver (solar cell panel) 201B on the cage side generates an electric power.

[0028] In the examples shown in Figs. 7(a) to 7(d), although the movable body power receiver 201B is buried in the cage wall, it may be adhered to the cage wall. Alternatively, the movable body power receiver 201B may be mounted on the ceiling top or floor bottom. The rectifier 51 connected to the movable body side power receiver 201B may be mounted at any position of the cage: a cage upper position, a cage lower position, a cage wall, a door inner region and the like, so long as it moves together with the elevator cage.

[0029] Fig. 7(e) is a diagram illustrating positive power feeding utilizing a drive force of the door motor. A drive force of the door motor operates the movable body power receiver 201B via a pulley 103 and a power receiving pulley 119. In contact power feeding, reliable contact can be realized by protruding the movable body power receiver 201B when the doors are closed more than when the doors are opened. Also in non-contact power feeding, the gap between transformers (or between microwave power transmitter and receiver or between a solar cell and a light source) can be shortened so that the power transmission efficiency can be improved considerably. Since the door motor is utilized, a new drive source is not necessary and an inexpensive mechanism can be incorporated effectively.

[0030] Fig. 8 shows enlarged views of the movable body side power receiver 205B mounted on the cage side sill 109 and the charger side power transmitter 205A mounted on the elevator stop side sill 116 in the state immediately before the elevator cage and the elevator stop face each other respectively shown in Figs. 6(a) and 6(b). Fig. 8(a) is a diagram illustrating contact power feeding, wherein the movable body side power receiver (electrode made of a conductor) 205B is mount-

ed on the cage side sill 109 and the charger side power transmitter (electrode made of a conductor) 205A is mounted on the elevator stop side sill 116. Power feeding is performed when the elevator cage stops at the elevator stop, the cage side sill 109 and the elevator stop side sill 116 face each other and then the charger side power transmitter 205A and the movable body side power receiver 205B contact each other.

[0031] Fig. 8(b) is a diagram illustrating non-contact power feeding by magnetic coupling. Power feeding is performed by magnetic coupling when the elevator cage stops at the elevator stop and the charger side power transmitter (non-contact power feeding transformer on the charger side) 205A and the cage side movable body side power receiver (non-contact power feeding transformer on the cage side) 205B face each other. Since the sill is controlled to have a step of ± 5 mm in the stop state, power feeding can be performed at a high precision. The charger 4 for supplying the power to the charger side power transmitter 205A may be mounted at any position on the elevator stop side so long as the charger does not obstruct the motion of the elevator cage. The rectifier 51 connected to the movable body side power receiver 205B may be mounted at any position of the cage: a cage upper position, a cage lower position, a cage wall, a door inner region and the like, so long as it moves together with the elevator cage. Although not shown, power feeding may be performed by non-contact power feeding using microwaves and non-contact power feeding using a solar cell as shown in Figs. 7(c) and 7(d). Power feeding may be performed by utilizing a drive force of the door motor as shown in Fig. 7(e).

[0032] Fig. 9 shows enlarged views of the movable body side power receiver 202B mounted on the cage side door 106 and the charger side power transmitter 202A mounted on the elevator stop side door 113 in the state immediately before the elevator cage and the elevator stop face each other respectively shown in Figs. 6(a) and 6(b). Fig. 9(a) is a diagram illustrating non-contact power feeding, wherein the movable body side power receiver (electrode made of a conductor) 202B is mounted on the cage side door 106 and the charger side power transmitter (electrode made of a conductor) 202A is mounted on the elevator stop side door 113. Power feeding is performed when the elevator cage stops at the elevator stop, the cage side door 106 and the elevator stop side door 113 face each other and then the charger side power transmitter 202A and the movable body side power receiver 202B contact each other.

[0033] Fig. 9(b) is a diagram illustrating non-contact power feeding by magnetic coupling. Power feeding is performed by magnetic coupling when the elevator cage stops at the elevator stop and the charger side power transmitter (non-contact power feeding transformer on the charger side) 202A and the cage side movable body side power receiver (non-contact power feeding transformer on the cage side) 202B face each other. Since the door is coupled to the sill whose position precision is guaranteed, the position precision is higher than that when the charger side power transmitter 202A is mounted on the lifting path wall. Generally, when a building is constructed, the lifting path wall is designed by a construction corporation and it is very difficult for an elevator maker to form a hole and mount the charger side power transmitter at a high precision. In contrast, the door can be worked relatively easily at a high precision by an elevator maker. The charger 4 for supplying the power to the charger side power transmitter 202A may be mounted at any position on the elevator stop side so long as the charger does not obstruct the motion of the elevator cage. The rectifier 51 connected to the movable body side power receiver 202B may be mounted at any position of the cage: a cage upper position, a cage lower position, a cage wall, a door inner region and the like, so long as it moves together with the elevator cage. Although not shown, power feeding may be performed by non-contact power feeding using microwaves and non-contact power feeding using a solar cell as shown in Figs. 7(c) and 7(d). As shown in Fig. 7(e), power feeding may be performed by utilizing the drive force of the door motor.

[0034] Fig. 10 shows enlarged views of the movable body side power receiver 203B mounted on the cage side door frame 107 and the charger side power transmitter 203A mounted on the three-side frame 114 in the state immediately before the elevator cage and the elevator stop face each other respectively shown in Figs. 6(a) and 6(b). Fig. 10(a) is a diagram illustrating contact power feeding, wherein the movable body side power receiver (electrode made of a conductor) 203B is mounted on the cage side door frame 107 and the charger side power transmitter (electrode made of a conductor) 203A is mounted on the three-side frame 114. Power feeding is performed when the elevator cage stops at the elevator stop, the cage side door frame 107 and the three-side frame 114 face each other and then the charger side power transmitter 203A and the movable body side power receiver 203B contact each other. Fig. 10(b) is a diagram illustrating non-contact power feeding by magnetic coupling. Power feeding is performed by magnetic coupling when the elevator cage stops at the elevator stop and the charger side power transmitter (non-contact power feeding transformer on the charger side) 203A and the cage side movable body side power receiver (non-contact power feeding transformer on the cage side) 203B face each other. Since the cage side door frame and the three-side frame are coupled to the sills whose position precision is guaranteed, the position precision is higher than that when the charger side power transmitter 203A is mounted on the lifting path wall. Similar to the door shown in Fig. 8, since an elevator maker can perform a mount work, the position precision can be improved relatively easily. The charger 4 for supplying the power to the charger side power transmitter 203A may be mounted at any position on the elevator stop side so long as the charger does not obstruct the

motion of the elevator cage. The rectifier 51 connected to the movable body side power receiver 203B may be mounted at any position of the cage: a cage upper position, a cage lower position, a cage wall, a door inner region and the like, so long as it moves together with the elevator cage. Although not shown, power feeding may be performed by non-contact power feeding using microwaves and non-contact power feeding using a solar cell as shown in Figs. 7(c) and 7(d). As shown in Fig. 7 (e), power feeding may be performed by utilizing the drive force of the door motor.

[0035] Fig. 11 shows enlarged views of the movable body side power receiver 204B mounted on the support member 108 fixed to the cage side door frame 107. Fig. 11(a) is a diagram illustrating contact power feeding, wherein the movable body side power receiver (electrode made of a conductor) 204B is mounted on the support member 108. Power feeding is performed when the elevator cage stops at the elevator stop and the movable body side power receiver 204B and an unrepresented charger side power transmitter mounted on the support member 115 fixed to the three-side frame contact each other. Fig. 11(b) is a diagram illustrating non-contact power feeding by magnetic coupling. Power feeding is performed by magnetic coupling when the elevator cage stops at the elevator stop and an unrepresented charger side power transmitter (non-contact power feeding transformer on the charger side) mounted on the support member 115 fixed to the three-side door frame and the cage side movable body side power receiver (non-contact power feeding transformer on the cage side) 204B face each other. Since the cage side door frame and the three-side frame are coupled to the sills whose position precision is guaranteed, the position precision can be improved by using the support member fixed to the three-side frame or the like. Similar to the door shown in Fig. 8, since an elevator maker can perform a mount work, the position precision can be improved relatively easily. The rectifier 51 connected to the movable body side power receiver 204B may be mounted at any position of the cage: a cage upper position, a cage lower position, a cage wall, a door inner region and the like, so long as it moves together with the elevator cage. Although not shown, power feeding may be performed by non-contact power feeding using microwaves and non-contact power feeding using a solar cell as shown in Figs. 7(c) and 7(d).

[0036] Fig. 12 shows enlarged views of the movable body side power receiver 206B mounted on the apron 110 and the charger side power transmitter 206A mounted on the door guard 117 in the state immediately before the elevator cage and the elevator stop face each other respectively shown in Figs. 6(a) and 6(b).

[0037] The movable body side power receiver 206B and the charger side power transmitter 206A are mounted in the openings formed through the apron and door guide, the openings being as small as they do not damage the essential function of the apron and door guide.

[0038] Fig. 12(a) is a diagram illustrating non-contact power feeding, wherein the movable body side power receiver (electrode made of a conductor) 206B is mounted on the apron 110 and the charger side power transmitter (electrode made of a conductor) 206A is mounted on the door guide 117. Power feeding is performed when the elevator cage stops at the elevator stop, the apron 110 and the door guide 117 face each other and then the charger side power transmitter 206A and the movable body side power receiver 206B contact each other.

[0039] Fig. 12(b) is a diagram illustrating non-contact power feeding by magnetic coupling. Power feeding is performed through magnetic coupling when the elevator cage stops at the elevator stop and when the charger side power transmitter (charger side non-contact power feeding transformer) 206A and the cage side movable body side power receiver (cage side non-contact power feeding transformer) 206B face each other. Since the apron and the door guard are coupled to the sills whose position precision is guaranteed, the position precision is higher than that the charger side power transmitter 206A is mounted on the lifting path wall. Similar to the door shown in Fig. 8, since an elevator maker can perform a mount work, the position precision can be improved relatively easily. The charger 4 for supplying the power to the charger side power transmitter 206A may be mounted at any position on the elevator stop side so long as the charger does not obstruct the motion of the elevator cage. The rectifier 51 connected to the movable body side power receiver 206B may be mounted at any position of the cage: a cage upper position, a cage lower position, a cage wall, a door inner region and the like, so long as it moves together with the elevator cage. Although not shown, power feeding may be performed by non-contact power feeding using microwaves and non-contact power feeding using a solar cell as shown in Figs. 7(c) and 7(d). As shown in Fig. 7(e), power feeding may be performed by utilizing the drive force of the door motor.

[0040] Fig. 13 is an enlarged view showing the movable body side power receiver 207B mounted on the position detector 118. The position detector 118 is a device for detecting the position of the movable body in order to control the position thereof. When the position detector reaches a shielding plate 120 mounted in the lifting path, a reed switch turns off so that an arrival signal is issued. The position detector 118 and the shielding plate 120 are mounted by adjusting the position error to fall within several mm or shorter. As shown in Fig. 13, the position error between the power transmitter and receiver becomes small by fixing the movable body side power receiver 207B to the position detector 118 and the charger side power transmitter 207A to the shielding plate 120, so that power feeding can be performed at a high precision. Power feeding may be either contact power feeding or non-contact power feeding.

[0041] Fig. 14 show enlarged views of the engaging plates 105 and the engaging rollers 112 when the cage

side door and the elevator stop side door face each other. Fig. 14(a) is a front view and Fig. 14(b) is a top view. When the doors face each other, as shown in Fig. 14 the engaging rollers 112 mounted on the elevator stop side door are inserted into the region between the engaging plates 105 mounted on the cage side door. In this state, as the engaging plates 105 are moved by the drive force of the unrepresented door motor, the doors on the elevator stop side can be opened and closed in response to driving the cage side doors. In the arrangement shown in Fig. 14, the engaging plates 105 and engaging rollers 112 are made of conductor, and power is supplied from the elevator stop side to the elevator cage when the engaging rollers connected to the charger and the engaging plates connected to the cage side rectifier contact each other. The arrangement shown in Fig. 14 provides a very high position precision and no electrode is used so that compactness and low cost can be realized effectively.

[0042] Fig. 15 shows an example wherein a movable body power receiver 208B and a charger side power transmitter 208A are mounted on the engaging plate 105 and the engaging roller 112 shown in Fig. 14. This example method provides a very high position precision similar to that shown in Fig. 14, and can be realized by the simple structure that inexpensive electrodes are formed on the engaging plate and the engaging roller.

[0043] Fig. 16 shows a cage and doors on the elevator stop side as viewed from the lifting path side, respectively of an elevator of the door open/close type different from that shown in Fig. 6.

[0044] The example shown in Fig. 6 drives the doors by using a cooperative rope, whereas the example shown in Fig. 16 presents an elevator whose doors are opened and closed by using levers. Figs. 16(a) and 16 (b) are detailed views of the elevator cage and the doors on the elevator stop side as viewed from the lifting path side. 121 represents engaging plates, 122 represents engaging devices, 123 represents sub-levers, 124 represents a door motor and 125 represents a pulley. The engaging plates 121 are mounted on the elevator stop side doors and the engaging devices 122 are mounted on the cage side doors.

[0045] The doors shown in Fig. 16 are opened and closed by transmitting a drive force of the door motor 124 to the engaging devices via the pulley 125 and the sub-levers 123. When the elevator stop side doors face the cage side doors, the engaging devices 122 are engaged with the engaging plates 121 so that the elevator side doors can be opened and closed in response to driving the cage side doors.

[0046] Fig. 17 shows enlarged views of the engaging plates 121 and the engaging devices 122 when the cage side door and the elevator stop side door shown in Fig. 16 face each other. Fig. 17(a) is a front view and Fig. 17 (b) is a top view. In the arrangement shown in Fig. 17, the engaging plates 121 and engaging devices 122 are made of conductor, and power is supplied from the elevator stop side to the elevator cage when the engaging devices 122 connected to the charger and the engaging plates 121 connected to the rectifier contact each other. The arrangement shown in Fig. 17 provides a very high position precision and no electrode is used so that compactness and low cost can be realized effectively.

[0047] Fig. 18 shows the movable body side power receiver 209B and the charger side power transmitter 209A respectively connected to the engaging plate 121 and the engaging device 122 shown in Fig. 17. This method can be realized by the simple structure that inexpensive electrodes are disposed on the engaging plate and engaging roller already used. In addition, its position precision is very high similar to that shown in Fig. 17.

[0048] A method of mounting the movable body side power receiver and the charger side power transmitter shown in Fig. 16 is similar to that described with Fig. 6, expecting the mount of the engaging plates 121 and the engaging devices 122.

[0049] Next, detailed description will be given on the charger side power transmitter 1A and the movable body side power receiver 1B of the first embodiment shown in Fig. 1 which perform non-contact power feeding using magnetic coupling. The charger side power transmitter 1A and the movable body power receiver 1B use a non-contact power feeding transformer. The non-contact power feeding transformer is associated with a problem of a low coupling factor. The coupling factor is a ratio of a power transmitted to the rectifier 51 to the power fed from the charger 4. If the coupling factor is raised, it is possible to realize compactness of the charger 4 and reduction of leakage fluxes.

[0050] A non-contact power feeding transformer will be described with reference to Figs. 19 and 20.

[0051] In the following description, a charger side transformer 1A0 corresponds to the charger side power transmitter 1A and a movable body side power receiver 1B0 corresponds to the movable body side power receiver 1B.

[0052] Fig. 19 is a top view of the charger side transformer 1A and the movable body side transformer 1B during power feeding. 1B1 represents a core of the movable body side transformer 1B0, and 1B2 represents a coil of the movable body side transformer 1B0. A z-axis corresponds to a direction perpendicular to the drawing sheet. In Fig. 19, a magnetic flux distribution generated during power feeding is also drawn (broken lines). Fig. 20(a) is a cross sectional view of the charger side transformer 1A0 as viewed along an arrow direction shown in Fig. 19. 1A1 represents a core of the charger side transformer 1A, 1A2 represents a coil of the charger side transformer 1A0, and 1A3 represents a coil winding of the charger side transformer 1A0. Fig. 20(b) is a cross sectional view of the charger side transformer 1A0 as viewed from the upper side. The coil winding 1A3 is wound in a superposed manner as shown in Fig. 20(a), and winding ends are connected to the charger. As seen

from Fig. 20(b), the coil winding is wound in such a manner that the length along the superposition direction is set greater than the coil width (the reason why the coil winding is wound in the superposition manner will be later described). Similarly the coil 1B2 of the movable body side transformer is formed through winding in the superposition manner and the winding ends thereof are connected to the rectifier. The coil 1A2 is formed by molding the coil winding 1A3 with resin or the like. The coil winding 1A3 may be wound directly about a winding frame.

[0053] Since the non-contact power feeding transformer is mounted on the moving body, it can be considered that the transformers move at high speed. It is therefore necessary to have a relatively large gap width between the charger side transformer and the movable body side transformer, this point being very different from a general transformer. The requirements of the gap width of a transformer of the present application will be later described in detail. Generally, as the gap width becomes broad, leakage fluxes increase and the transformer coupling factor, i.e., the power transmission efficiency, lowers. The gap width of a general transformer is therefore very narrow relative to a magnetic path. How leakage fluxes are reduced is important in the case of the gap width of this application.

[0054] Referring to Fig. 19, the coil of the charger side transformer 1A0 is wound in parallel to the y-z plane in a superposed manner (refer to Fig. 3(a)). Magnetic fluxes are therefore generated along the x-axis direction. The generated magnetic fluxes are classified into two types, those passing through the movable body side transformer 1B0 and those leaking to the external. If there are many magnetic fluxes leaked to the external, the power transmission efficiency lowers so that it is necessary to increase the capacity of the charger 4 unnecessarily and that adverse effects may happen such as heat generation and electromagnetic interference to be caused by electromagnetic induction. It is therefore necessary to make external leakage fluxes as small as possible. As shown in Fig. 19, leakage fluxes can be reduced by incorporating the structure (CI-shaped transformer structure) that the opposite ends of the charger side transformer 1A0 and the opposite ends of the movable body side transformer 1B0 are positioned on the same straight line parallel to the x-axis. In the following, the shape of the core of the charger side transformer 1A0 is called an I-shape and the shape of the core of the movable body side transformer 1B0 is called a C-shape. This naming relies upon the similarities of the core shapes to alphabetical letters "I" and "C", respectively.

[0055] It is needless to say that the "C-shape" is required to have a curve like the alphabetical letter C. The C-shape may be an integrated angled shape such as shown in Fig. 19, or it may be formed by five straight cores adhered to together. In the latter case, although there is some loss at the adhesion points, this hardly poses a problem because the loss at the gap between the transformers is far more dominant. Although the movable body side transformer 1B0 shown in Fig. 19 has the C-shape symmetrical to the charger side transformer 1A0, it may be asymmetrical. It is important to adopt the transformer structure that the opposite ends of each of the charger side and movable body side transformers are positioned on the same straight line. It is necessary to make the charger side transformer and the movable body side transformer of the CI type pass by each other. Therefore, both the transformers are not superposed when they are projected along the motion direction of the movable body. Another feature is that as shown in Fig. 19 the direction of inserting the I-type transformer into a region between the confronting ends of the C-type transformer is not limited only to one-dimensional direction such as the x-axis direction and y-axis direction, but the I-type transformer may be inserted between the confronting ends of the C-type transformer along any direction. As shown in Fig. 21, still another feature resides in that the end (point a) of the charger side transformer 1A0 on the side of the movable body side transformer 1B0 is positioned nearer to the side of the movable body side transformer 1B0 more than the end (point a') of the movable body side transformer 1B0 on the side of the charger side transformer 1A0.

[0056] If the above-described conditions are met, the shape of the transformer can be modified in various ways. For example, as shown in Figs. 22 and 23, the structure that a plurality of coils are provided for the charger side transformer has the effects similar to those of the CI-type transformers. In the structures shown in Figs. 22 and 23, the movable body side transformer 1B0 has two gaps formed in the core 1B1 of the shape that a rectangular core is partitioned by a straight center core and the coils 1B2 attached to the gap edges, and the charger side transformer 1A0 of the I-shape is inserted into the gaps of the movable body side transformer 1B0. In Figs. 22 and 23, although the coils of each transformer are serially connected, they may be connected in parallel or may be made independent. As shown in Fig. 24, a coil may be wound about only one end portion of a C-shape transformer. In the structure shown in Fig. 24, although the coupling factor lowers slightly than that of the structure shown in Fig. 19, it is effective that the transformer can be assembled easily.

[0057] In a general transformer, the width of a coil is made broad to uniformly wind a winding relative to the core. This is because uniform winding of a general transformer having a small gap width can reduce leakage fluxes. In the structure of a general transformer, it is not good to wind a coil in a concentrated way (superposed way) such as shown in Fig. 19. If the gap width is relatively broad as in this invention, magnetic fluxes generated by the charger side transformer 1A0 tend to expand outside of the transformer before they reach the movable body side transformer 1B0, as shown by the magnetic flux distribution shown in Fig. 19. By winding the

coil 1B2 of the movable body side transformer in the superposed way, magnetic fluxes not captured by the core 1B1 of the movable body side transformer can be absorbed so that the leakage fluxes can be reduced effectively.

[0058] Fig. 25(a) is a diagram showing comparison regarding the relation between the coupling factor and the coil shape of the same CI-type transformer. This comparison was made by changing the aspect ratio (coil superposed thickness/coil width) of each of the charger side and movable body side coils. A coupling factor ratio is normalized to the aspect ratio of 0.1. The cross section of the coil is constant. It can be seen from Fig. 25 (a) that as the aspect ratio increases, the coupling factor increases. As compared to the coupling factor at the aspect ratio of 0.1, the coupling factor at the aspect ratio of 1 increases by 6 % and that at the aspect ratio of 10 increases by 14 %. Although the coupling factor ratio changes more or less from the value shown in Fig. 25 (a) if the gap width and core cross sectional area are changed, there is no change in the tendency that the coupling factor increases as the aspect ratio increases. If the gap width is broad as in the present application, the coupling factor can be improved effectively by making the aspect ratio larger than 1.

[0059] Fig. 26 shows an example of a transformer having a coil aspect ratio not larger than 1, contrary to the case shown in Fig. 19. In this case, although the coupling factor lowers, the length (L) of the core in the direction perpendicular to the lifting path wall can be shortened as shown. It is therefore possible to shorten the distance between the lifting path wall and the moving body and reduce the lifting path area effectively.

[0060] Fig. 25(b) is a diagram showing comparison regarding the coupling factor when the coil position of the same CI-type transformer is changed. This comparison was made by changing the distance w between the core end and the coil respectively of the moving body side transformer. The coil shape has the aspect ratio of 10 and the coupling factor ratio is normalized at w = 0 mm. It can be seen from Fig. 25(b) that as the value w increases, the coupling factor lowers. In the example shown in Fig. 25, the coupling factor at w = 10 mm lowers by 10 % or more than that at w = 0 mm. Although the coupling factor ratio becomes different more or less from that shown in Fig. 25(b) depending upon the shapes of the coil and core, there is no change in the tendency that the coupling factor ratio lowers as the value w increases. Namely, it is possible to improve the coupling factor by disposing the coil as near to the core end as possible. It is therefore necessary to set the distance between the end face of the core through which main magnetic fluxes pass and the coil surface on the gap side, at least to 10 mm or shorter.

[0061] Leakage fluxes can be reduced by making large the core cross section at the position of the transformer core shown in Fig. 19. The excited inductance of a transformer depends largely upon the magnetic resistance of the gap and the magnetic resistance is inversely proportional to the cross sectional area. The excited inductance can therefore be increased by making large the core cross sectional area at the coil position without increasing the cross sectional area of the core.

[0062] Next, description will be given on the gap width between the charger side transformer 1A0 and the movable body side transformer 1B0. In the transformers shown in Fig. 19, the magnetic resistance as well as leakage fluxes lowers more as the gap widths (G1 and G2) between the charger side transformer 1A0 and the movable body side transformer 1B0 become narrower. In a movable body system, the gap width is not easy to be shortened and is required to be longer than a certain value, from the viewpoint of reliability and mount precision associated with a position displacement because the charger side transformer passes between the opposite ends of the movable body side transformer at high speed (how the gap width is determined will be later described). The structure of a moving body system is the same as that of a power feeder of an electric car or an electronic shaver in that the charger side transformer and the movable body side transformer are in a proximate state. However, a conventional system having power feeding as the object of the proximate state is different in nature from the present invention having both objects of moving the movable body and feeding power. Namely, the conventional system and invention system are different greatly in that whether the structure requires the gap width by all means from the safety standpoint or the structure allows a mold portion (outer frame portion) at a contact position.

[0063] The movable body 3 shown in Fig. 1 has unrepresented rollers so that it moves stably by making the rollers move along and in contact with the guide rail 6. The guide plate 8 covers the rollers. Fig. 27 is a top view of the guide plate 8. In Fig. 27, 11 represents a roller. The guide plate 8 is made of iron plate, covers the rollers 11 and is coupled to an unrepresented moving body. With this structure, the position displacement between the rail 6 and the movable body is always smaller than the distance (K1 or K2) between the rail 6 and the guide plate 8. Therefore, if the charger side transformer 1A is fixed to the transformer fixing jig 9 coupled to the guide rail 6, as in the first embodiment, a contact accident can be avoided by setting the gap width larger than at least the distance between the rial 6 and the guide plate 8. This condition can be written by (smaller value of G1 and G2) > (larger value of K1 and K2) by using the symbols shown in Figs. 2 and 5.

[0064] Some movable bodies do not have the guide rail 8 and the roller 11. Some types of movable bodies of the elevator system also do not have the guide rail 8 and the roller 11. A gap determining method will be described. Fig. 28 is a diagram illustrating a guide shoe. 12 represents the guide shoe, 12A represents a guide shoe metal region and 12B represents a guide shoe resin region. Fig. 28 (a) is an overall perspective view, and

Fig. 28(b) is a top view of the guide shoe 12. As shown in Fig. 28 (a), by squeezing the rail 6 with the guide shoe 12, the position displacement between the rail 6 and the movable body 3 can be suppressed without using the rollers. As shown in Fig. 28(b), the guide shoe 12 is made of the solid guide shoe metal region 12A and the guide shoe resin region 12B made of resin such as vinyl chloride and urethane. The guide shoe resin region 12B is always in contact with the rail 6. Since the guide shoe resin region 12B is made of soft material so as not to generate discomfort noises, the guide shoe has some motion margin. Contact accident can be avoided by setting the gap width broader than at least the motion margin of the guide shoe (horizontal motion margin K3, vertical motion margin K4). This condition can be written by (smaller value of G1 and G2) > (larger value of K3 and K4) by using the symbols shown in Figs. 2 and 6.

[0065] The distance between the rail and the guide plate and the motion margin of the guide shoe is presently smaller than 5 mm so that it is sufficient if the gap length is set to 5 mm or longer. This method of determining the gap width is not limited only to a CI-type transformer but is effective for general transformers using a UU-type core, a UI-type core or the like.

[0066] Next, description will be made on a method of suppressing the adverse effects to be caused by induction current generated by leakage fluxes.

[0067] Fig. 29 is a side view of the charger side transformer 1A0. 10A represents an insulator for fixing the charger side transformer. If a jig for fixing the charger side transformer 1A0 is made of metal such as iron, induction current will flow in the jig due to leakage fluxes. This induction current generates heat which may cause corrosion or the like. The adverse effects of induction current can be prevented by using insulator such as resin as the material of the fixing jig.

[0068] Fig. 30 is a side view of the movable body side transformer 1B0, and 10B represents an insulator for fixing the movable body side transformer. Also in this case, similar to the case of Fig. 29, induction current flowing in the jig can be suppressed. The height of the insulator 10B is set in such a manner that the lower surface of the movable body side transformer coil 1B2 is higher than the upper surface of the moving body 3. Induction current which may flow in the surface layer of the movable body 3 can therefore be reduced.

[0069] Next, a mount method for CI-type transformers will be described.

[0070] Fig. 31 illustrates a method of mounting transformers.

[0071] In the example shown in Fig. 1, the I-type charger side transformer 1A0 is fixed on the lifting path side and the C-type movable body side transformer 1B0 is fixed to the movable body 3, as shown in Fig. 31(a). Fig. 31 illustrates a reverse arrangement of transformers. From the comparison between the arrangements shown in Figs. 31(a) and 31(b), it can be seen that a portion of the C-type transformer shown in Fig. 31(a) can be mounted partially in the movable body 3 so that W1 < W2. Of the CI-type transformers, the I-type transformer is disposed on the lifting path side so that the lifting path area can be reduced. From the comparison between the I- and C-type transformers, it can be seen that the C-type transformer having a larger core is high in cost. Assuming that a charger is disposed at a plurality of positions (stop floors), it is effective to dispose the I-type transformer on the lifting path side from the viewpoint of cost.

[0072] Conversely, with the arrangement shown in Fig. 31(b), the coil on the movable body side can be made compact so that the movable body can be made light in weight. In terms of a wind pressure applied to the movable body side transformer in a high speed motion, the I-type transformer having a very simple structure is disposed on the movable body side to suppress the breakage danger effectively.

[0073] Fig. 32 shows an example of a changed mount position of a CI-type transformer. The charger side transformer fixing jig 9 is deformed in such a manner that the end face of each transformer is aligned with the plane generally perpendicular to the plane along which the movable body 3 and the rail 6 face each other. With this arrangement, the length W3 extending form the side wall of the movable body 3 can be made shorter than W1 and W2 shown in Fig. 30, so that the lifting path area can be reduced effectively.

[0074] Although the embodiments of the invention has been described above, the invention is not limited only to the above-described embodiments, but it is obvious that various modifications can be made without departing from the range not changing the aspects of the invention.

Claims

1. A movable body system comprising: a movable body; a guide rail for guiding a motion of said movable body; a power transmitter mounted on a building side; power supplying means connected to a power source mounted on a building for supplying power to said power transmitter; a power receiver mounted on said movable body for receiving power from said power transmitter; and power receiving means mounted on said movable body for receiving power from said power receiver, wherein said power transmitter is mounted on said guide rail,or a portion of said power transmitter is mounted on a member for supporting said guide rail or on a rail bracket for supporting said guide rail.

2. A movable body system comprising: a movable body; a guide rail for guiding a motion of said movable body; power supplying means mounted on a building side for supplying power toward said movable body; and power receiving means mounted on

said movable body for receiving power from said power supplying means, wherein said power supplying means is mounted on said guide rail or a portion of said power supplying means is mounted on a member for supporting said guide rail or on a rail bracket for supporting said guide rail.

3. A movable body system comprising: a movable body; a guide rail for guiding a motion of said movable body; a power transmitter mounted on a building side; a charger connected to a power source mounted on a building for supplying power to said power transmitter; a power receiver mounted on said movable body for receiving power from said power transmitter; and a battery mounted on said movable body for receiving power from said power receiver, wherein said power transmitter is mounted on said guide rail or a portion of said power transmitter is mounted on a member for supporting said guide rail or on a rail bracket for supporting said guide rail.

4. The movable body system according to claims 1 to 3, wherein said power transmitter is disposed near or at an end of said guide rail.

5. A movable body system comprising: a movable body; a guide rail for guiding a motion of said movable body; a primary transformer for non-contact power feeding mounted on a building side; a secondary transformer for non-contact power feeding mounted on said movable body to receive power from said primary transformer; and a battery mounted on said movable body for receiving power from said secondary transformer, wherein an outer end of said primary transformer on a side of said movable body is positioned nearer to said movable body than an outer end of said secondary transformer when the outer ends are projected along a motion direction of said movable body.

6. The movable body system according to claim 5, wherein the outer end of said primary transformer on the side of said movable body and the outer end of said secondary transformer are positioned on a same straight line.

7. The movable body system according to claim 5 or 6, wherein said primary transformer has a coil winding wound at an end portion of said primary transformer on the side of said movable body in a superposed way, and said secondary transformer has a coil winding wound at an end portion of said secondary transformer in a superposed way.

8. The movable body system according to claims 5 to 7, wherein said primary transformer has an I-type shape, and said secondary transformer has a C-type shape.

9. The movable body system according to claims 5 to 7, wherein said primary transformer has a C-type shape, and said secondary transformer has an I-type shape.

10. The movable body system according to claim 7, wherein a ratio of a thickness to a width respectively of a coil wound in the superposed way is at least 1 : 1 or larger, the thickness being greater than the width.

11. An elevator comprising: an elevator cage; a guide rail for guiding a motion of said elevator cage; a power transmitter mounted on a building side; a charger connected to a power source mounted on a building for supplying power to said power transmitter; a power receiver mounted on said movable body for receiving power from said power transmitter; and a battery mounted on said elevator cage for receiving power from said power receiver, wherein said power transmitter is mounted on said guide rail or a portion of said power transmitter is mounted on a member for supporting said guide rail, on a rail bracket for supporting said guide rail or on a door on an elevator stop side.

FIG.1

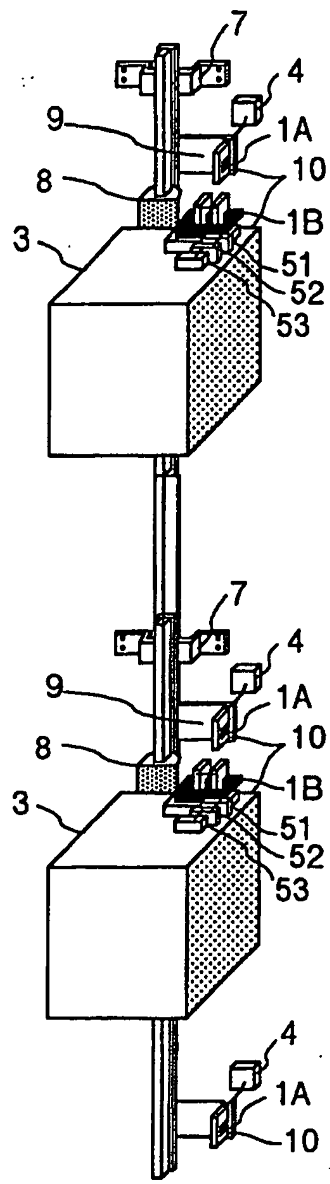


FIG.2

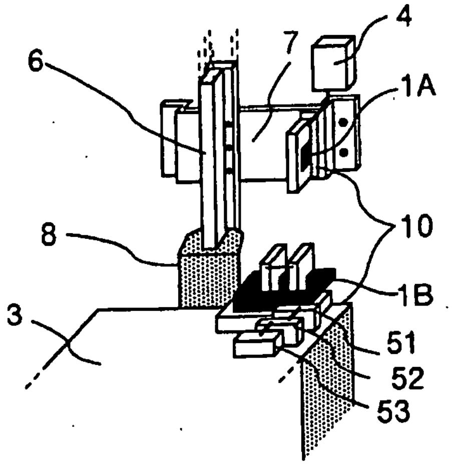


FIG.3

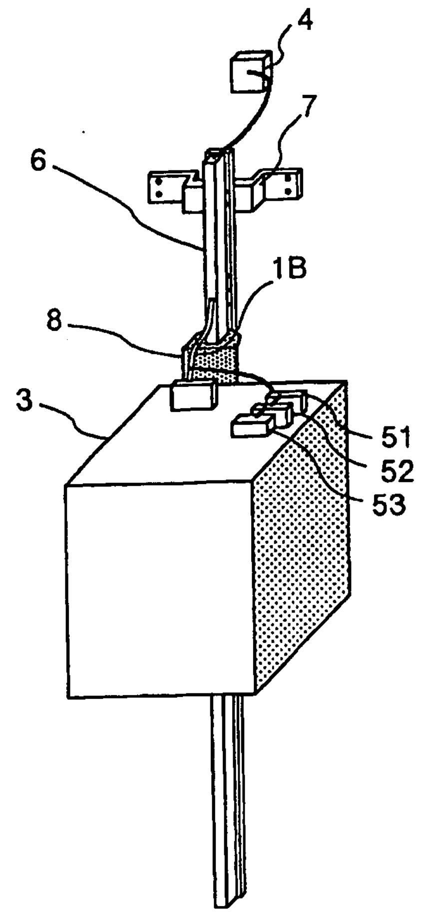


FIG.4

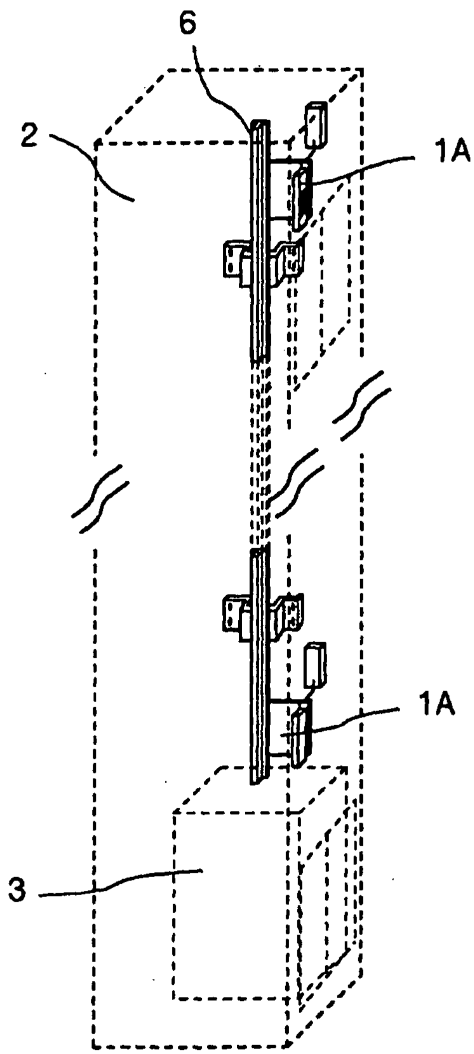


FIG.5

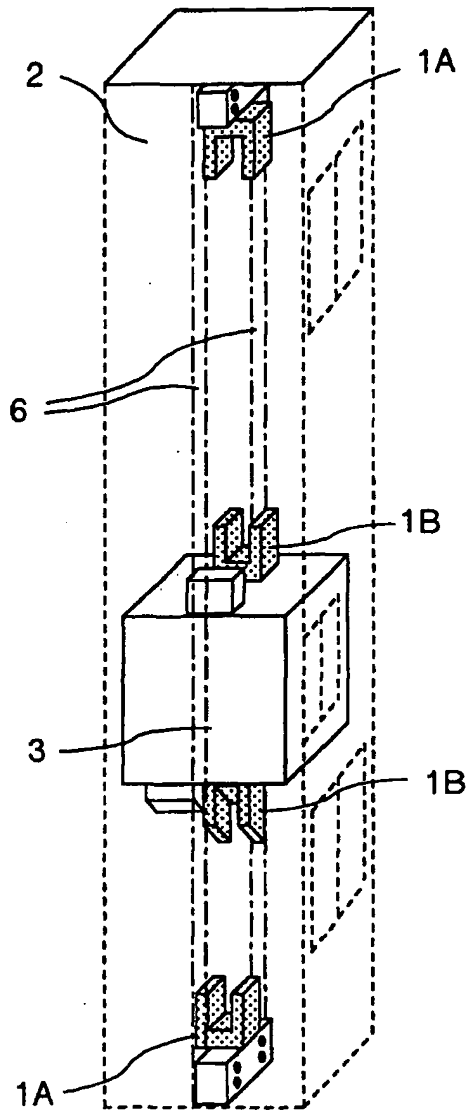
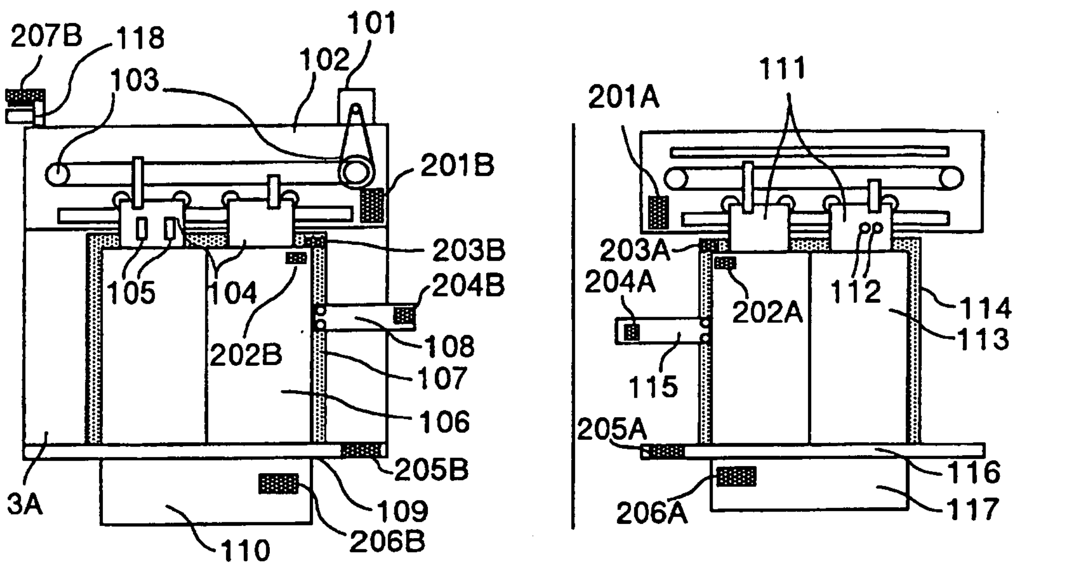


FIG.6



(a) DOORS ON CAGE SIDE

(b) DOORS ON STOP SIDE

FIG.7

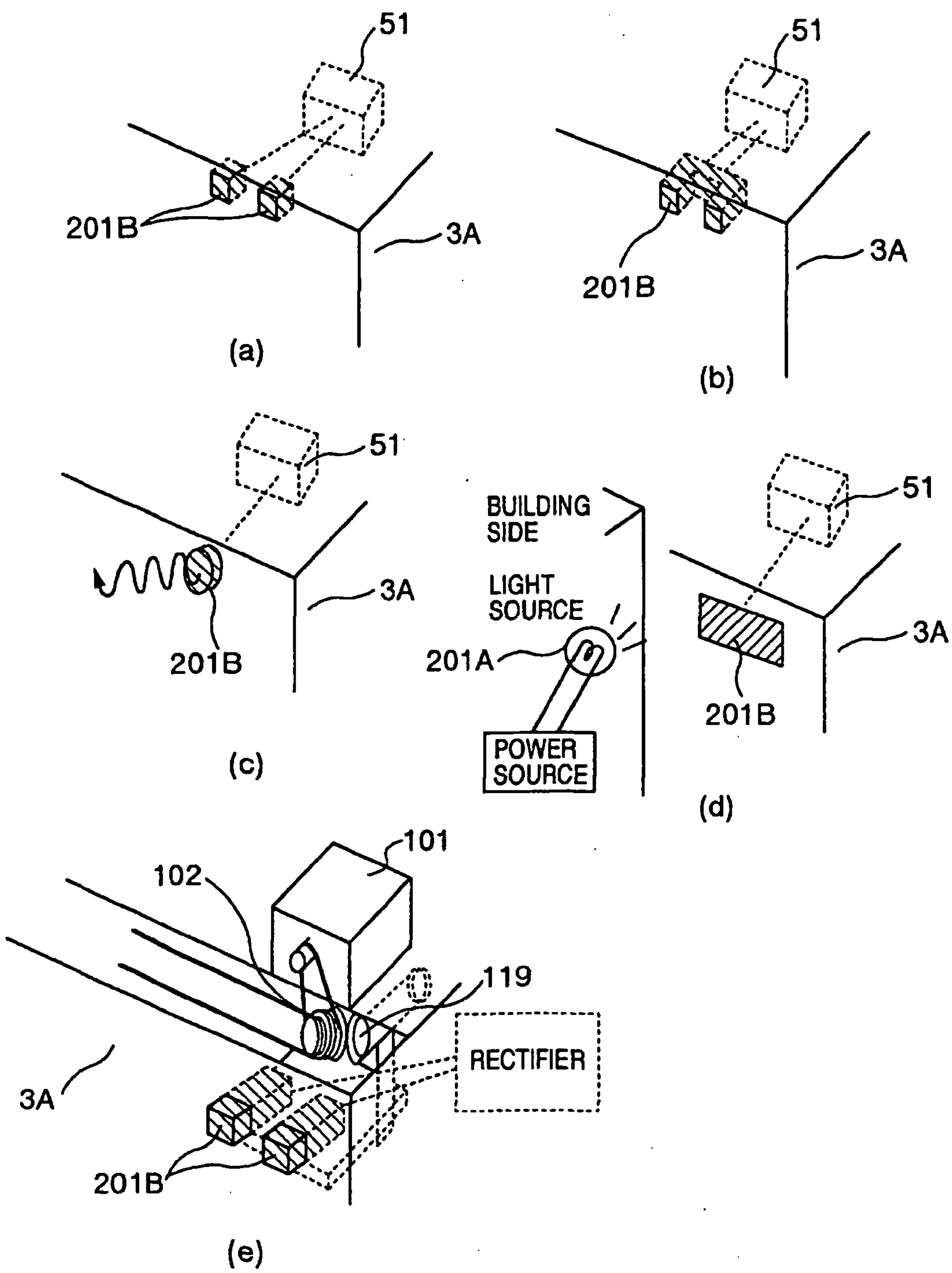
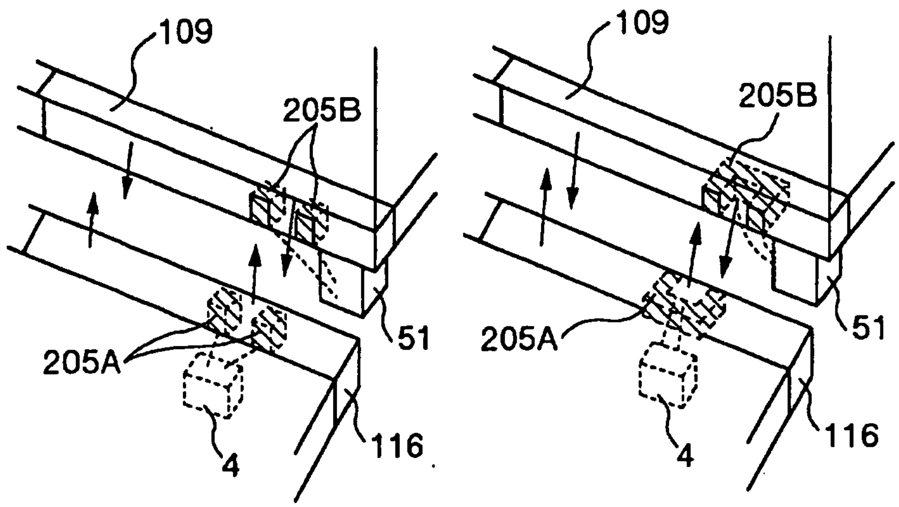
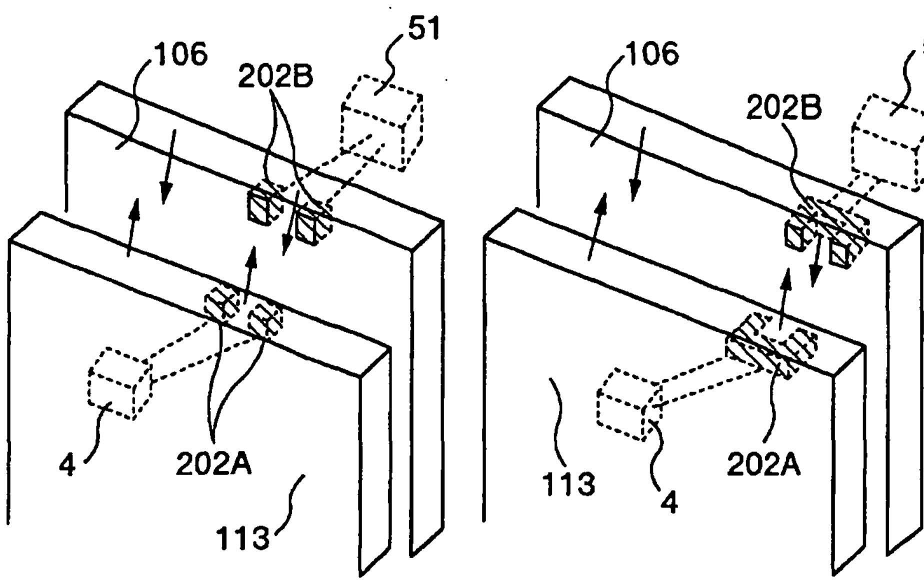

51
201B
3A
(a)
51
201B
3A
(b)
51
201B
3A
(c)
BUILDING
SIDE
LIGHT
SOURCE
201A
POWER
SOURCE
51
201B
3A
(d)
101
102
119
RECTIFIER
3A
201B
(e)

FIG.8



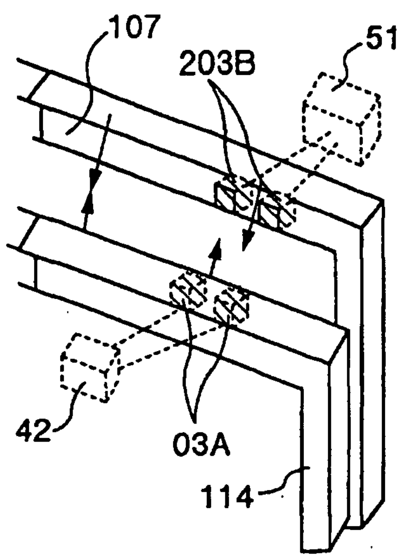
(a) (b)

FIG.9

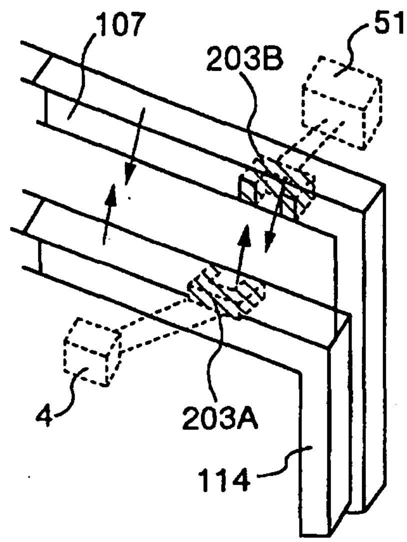


(a) (b)

FIG.10

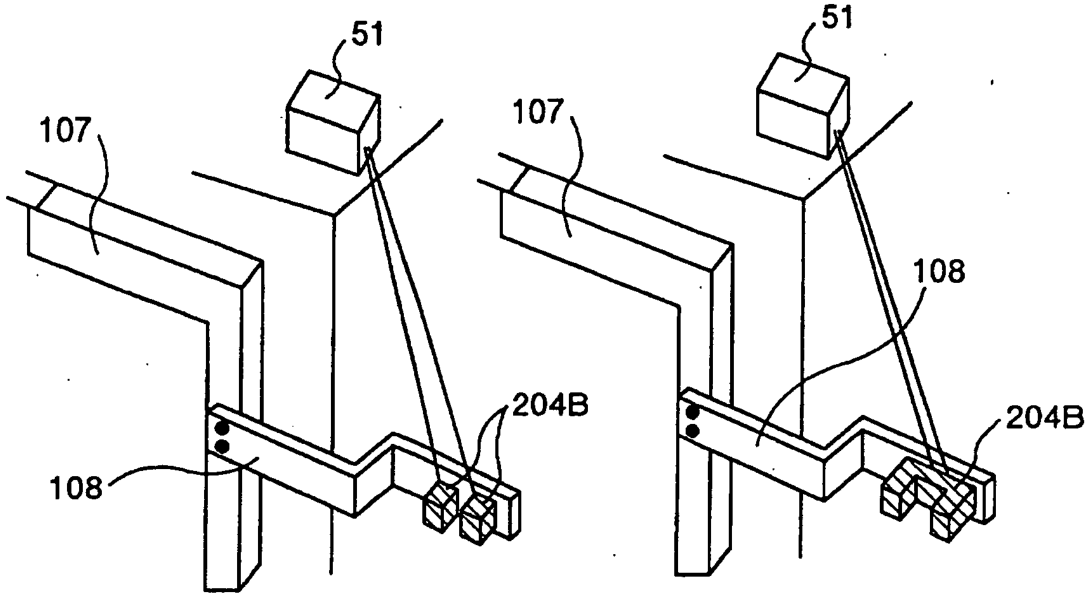


(a)



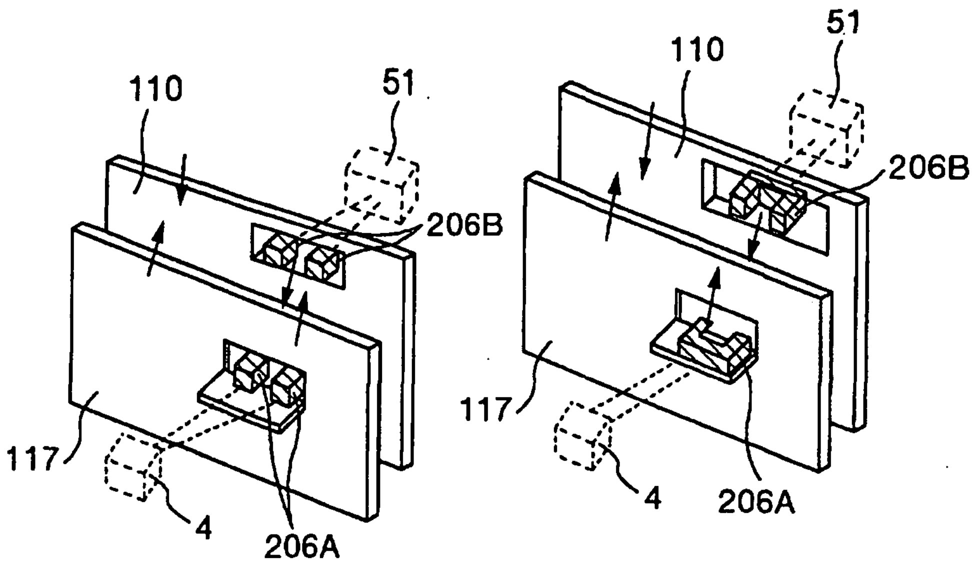
(b)

FIG.11



(a) (b)

FIG.12



(a) (b)

FIG.13

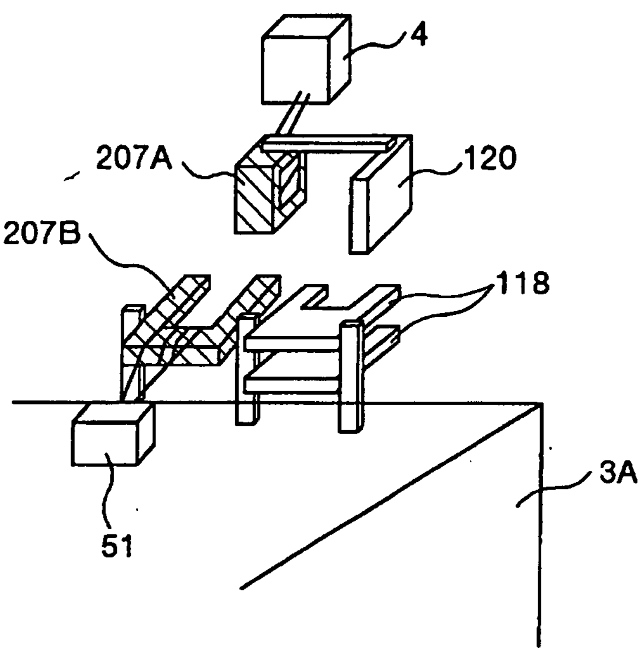
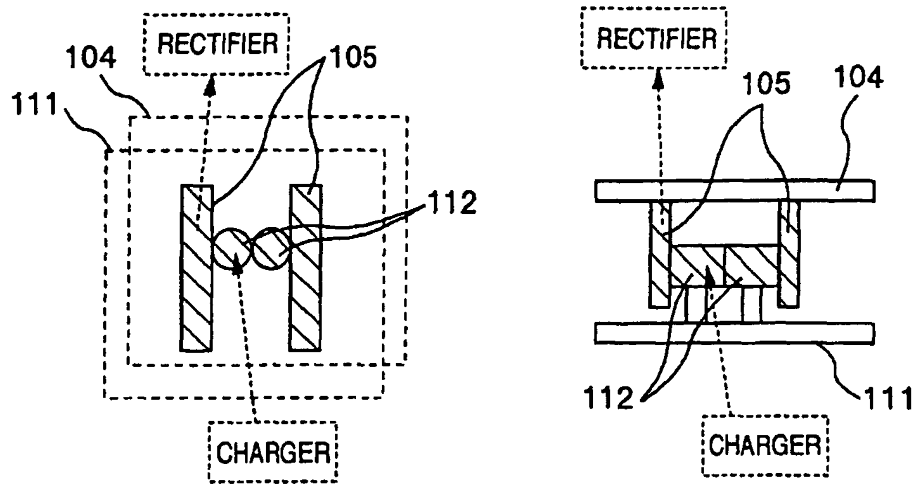
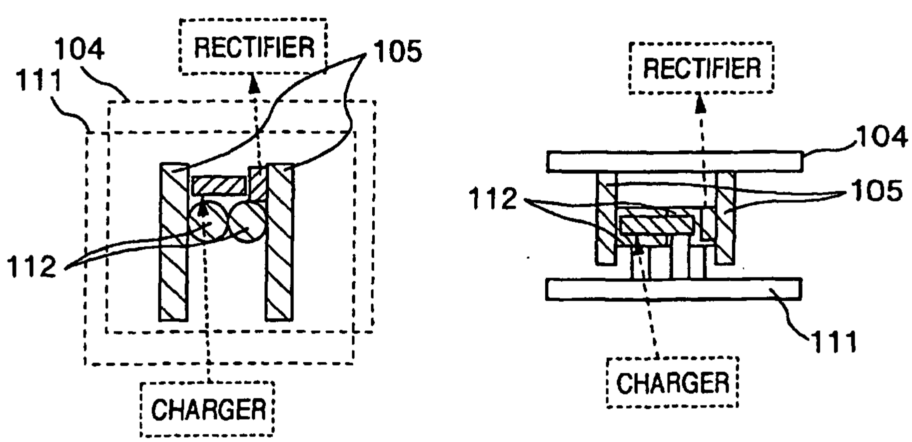


FIG.14



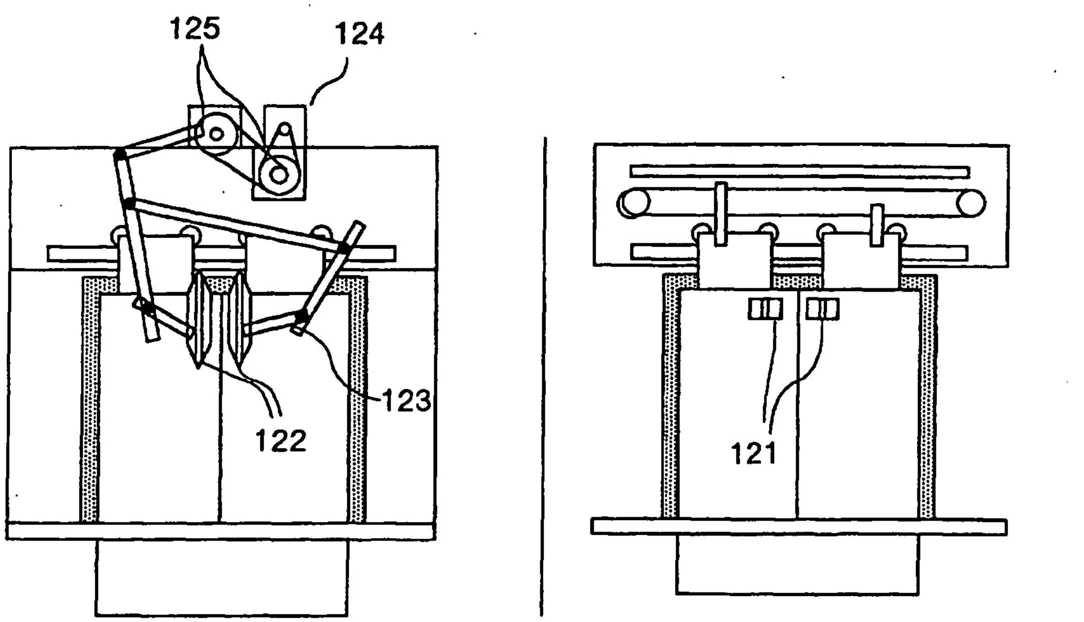
(a) (b)

FIG.15



(a) (b)

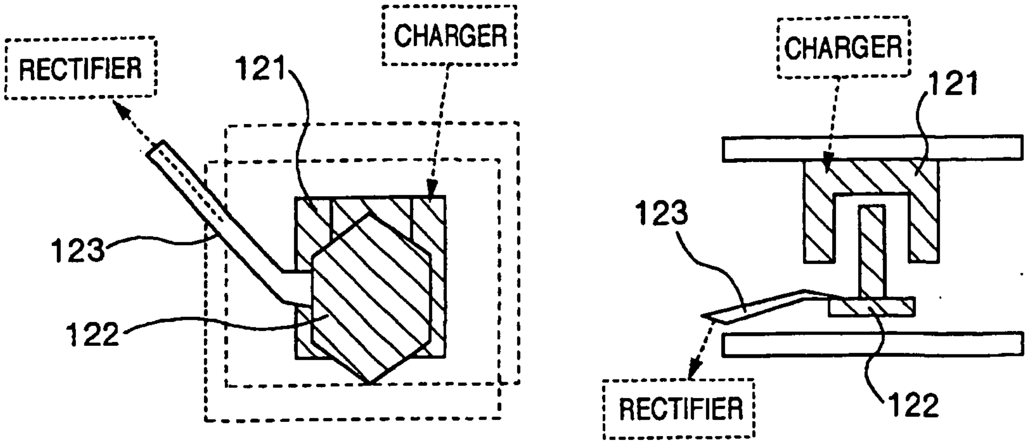
FIG.16



(a) DOORS ON CAGE SIDE

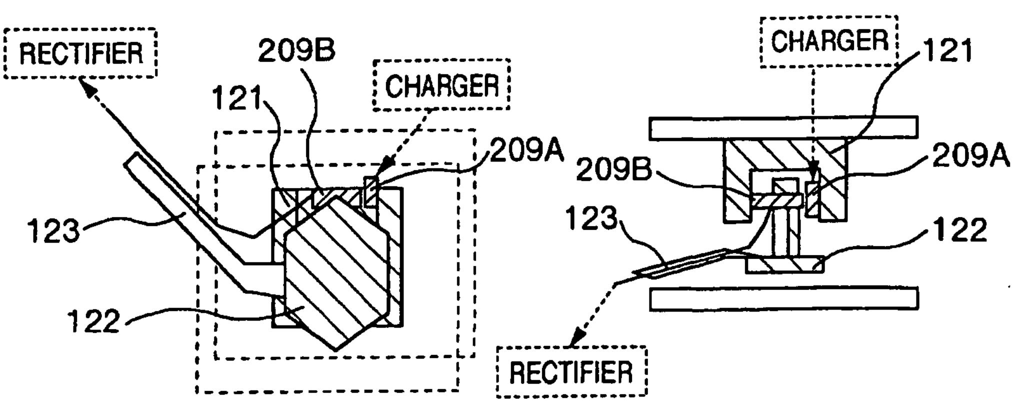
(b) DOORS ON STOP SIDE

FIG.17



(a) (b)

FIG.18



(a) (b)

FIG.19

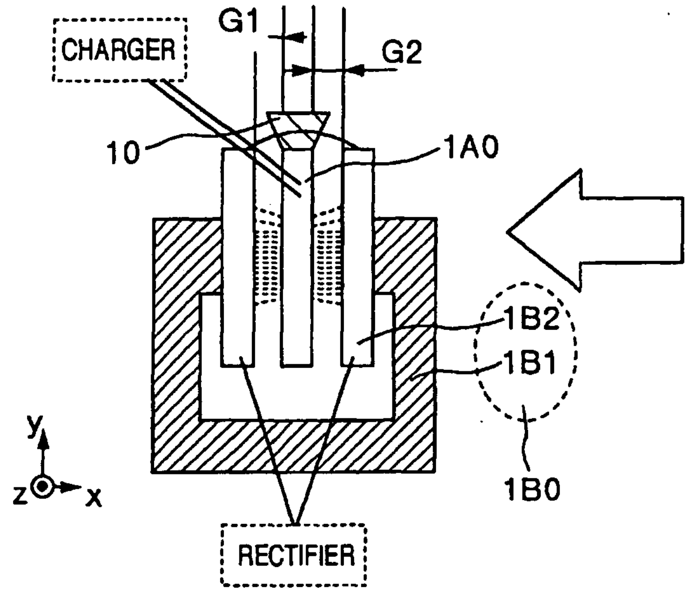

G1
CHARGER
G2
10
1A0
1B2
1B1
1B0
y
z
x
RECTIFIER

FIG.20

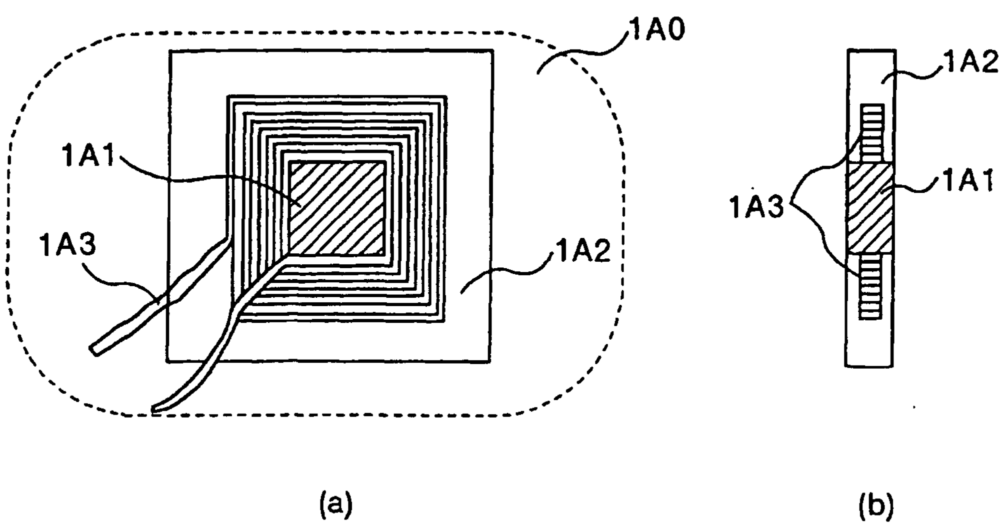

1A0
1A1
1A3
1A2
(a)
1A2
1A3
1A1
(b)

FIG.21

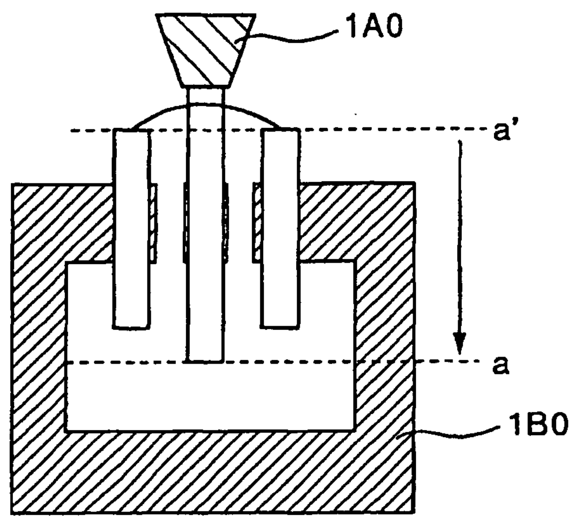


FIG.22

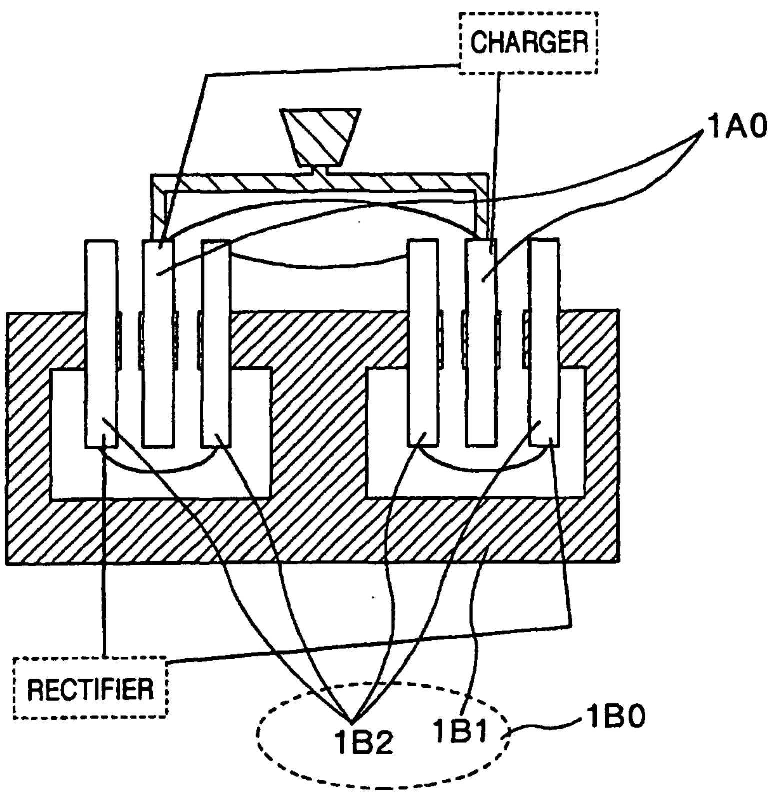


FIG.23

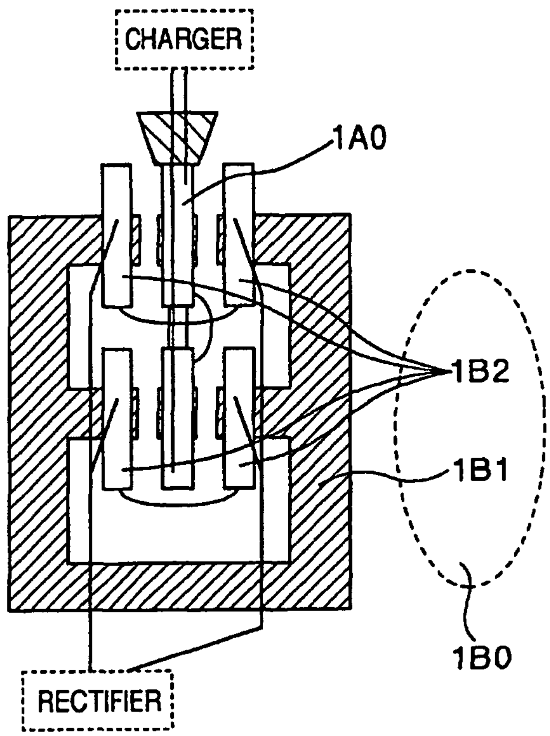


FIG.24

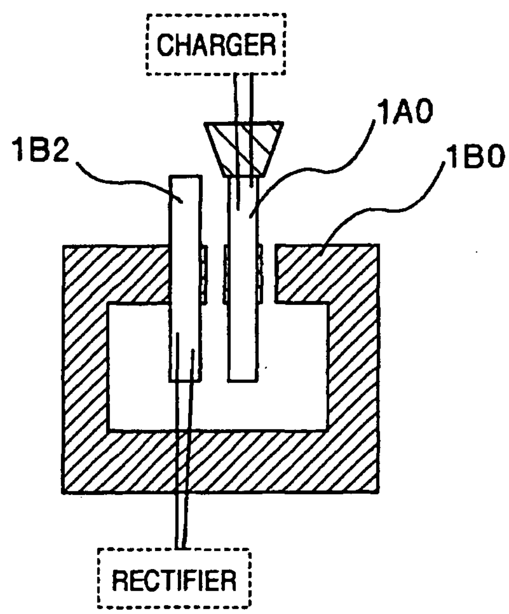
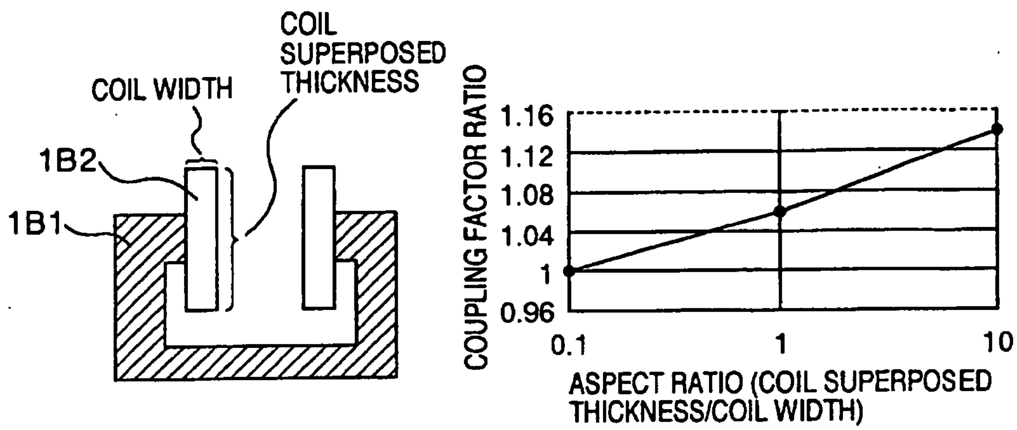
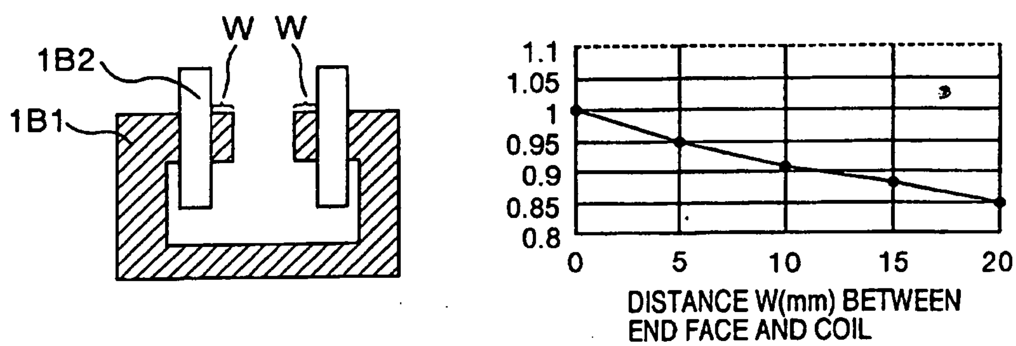


FIG.25



(a) COUPLING FACTOR RATIO WITH CHANGED COIL SHAPE



(a) COUPLING FACTOR RATIO WITH CHANGED COIL POSITION

FIG.26

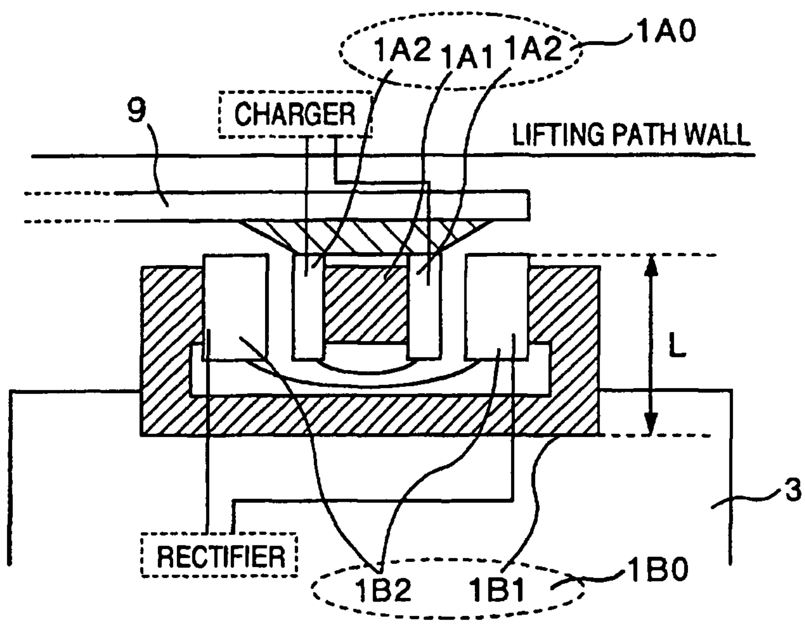

1A0
1A2
1A1
1A2
9
CHARGER
LIFTING PATH WALL
L
3
RECTIFIER
1B2
1B1
1B0

FIG.27

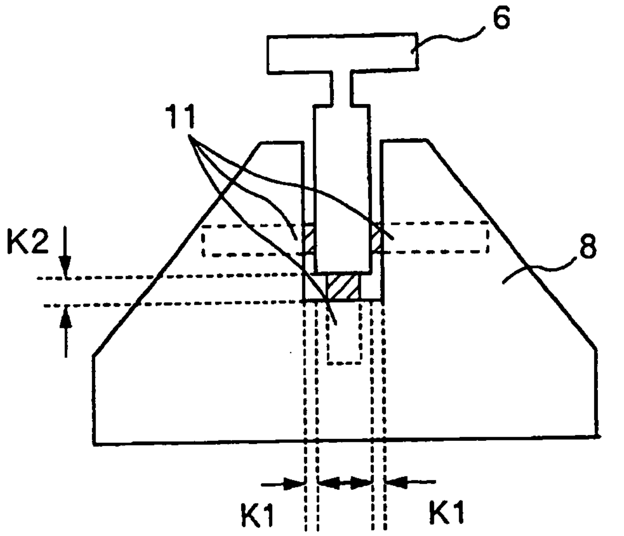


FIG.28

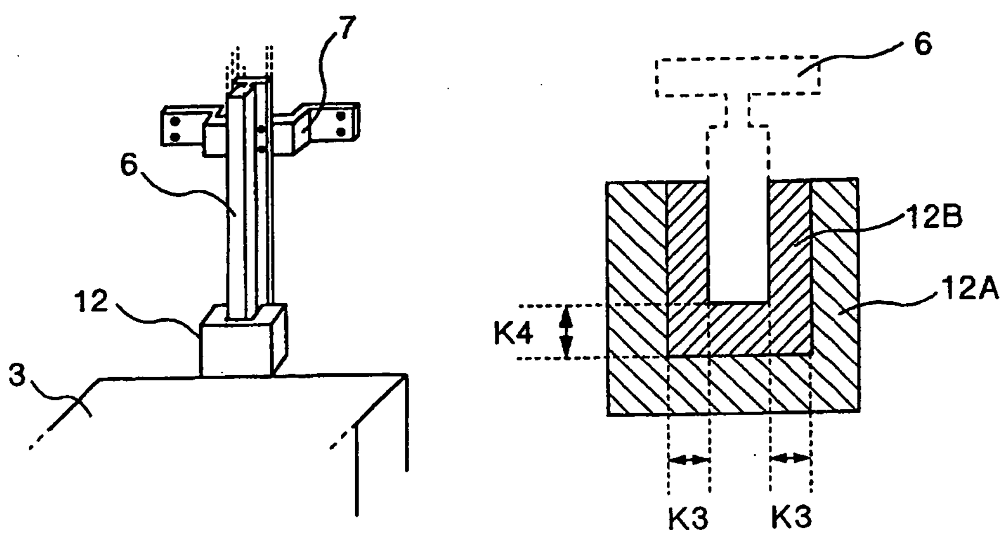


FIG.29

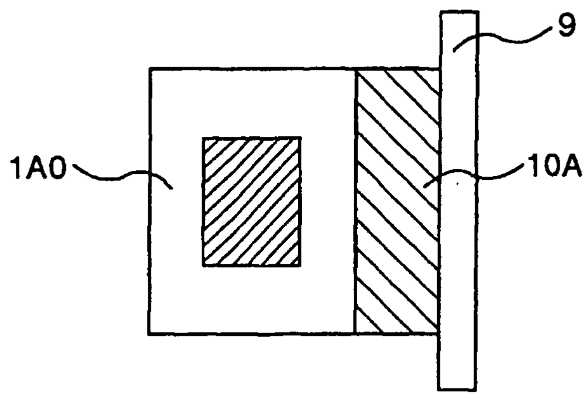


FIG.30

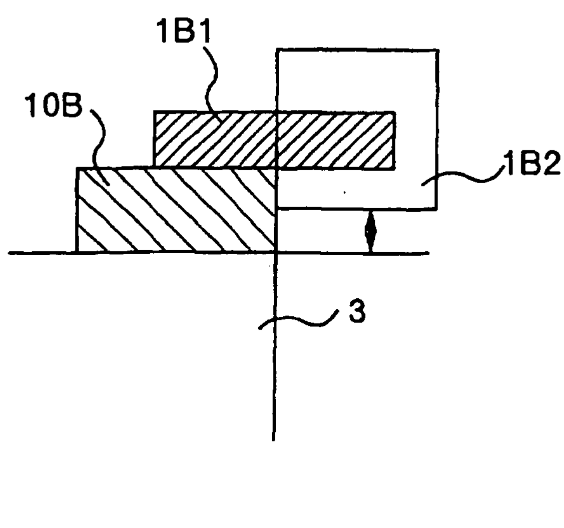
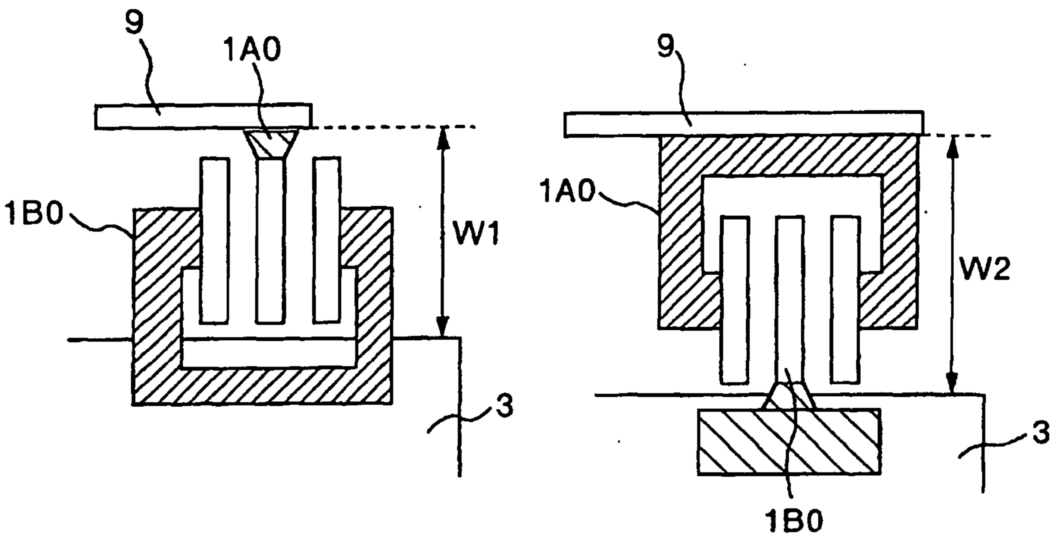
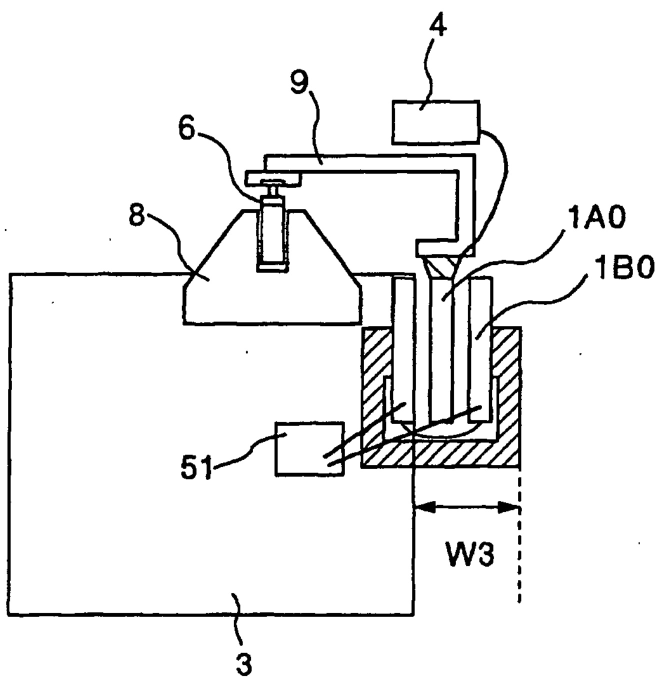


FIG.31



(a) (b)

FIG.32



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP01/04552

A. CLASSIFICATION OF SUBJECT MATTER
Int.Cl[7] B66B 1/34

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
Int.Cl[7] B66B 1/00-B66B 7/12

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Jitsuyo Shinan Koho	1922-1996	Jitsuyo Shinan Toroku Koho	1996-2002
Kokai Jitsuyo Shinan Koho	1971-2002	Toroku Jitsuyo Shinan Koho	1994-2002

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	JP7-206318 A (Toshiba Corporation), 08 August, 1995 (08.08.1995), (Family: none)	2 1-11
Y	JP 5-294568 A (Hitachi, Ltd., Hitachi Building System Eng. & Service Co., Ltd.), 09 November, 1993 (09.11.1993), (Family: none)	1-11
Y	JP 9-188487 A (Hitachi Building Systems Co., Ltd.), 22 July, 1997 (22.07.1997), (Family: none)	1-11
Y	JP 9-17665 A (Toyota Automatic Loom Works, Ltd.), 17 January, 1997 (17.01.1997), & US 5703461 A	5-11

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:
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"&" document member of the same patent family

Date of the actual completion of the international search 12 February, 2002 (12.02.02)	Date of mailing of the international search report 26 February, 2002 (26.02.02)
Name and mailing address of the ISA/ Japanese Patent Office	Authorized officer
Facsimile No.	Telephone No.

Form PCT/ISA/210 (second sheet) (July 1992)